TECHNICAL ANALYSIS

Tank Seam Road
Co-Op Mining Company
Bear Canyon Mine
ACT/015/025

July 20, 1994

BIOLOGICAL ANALYSIS

R645-301-321. Vegetation Information.

Plate 9-1, Vegetation Map, is included in the submittal for the proposed Tank Seam Road and Portal Pad. The new vegetation map has been updated to include the Tank Seam reference area. The existing vegetation in the area of the proposed disturbance is included on the map.

An inspection of the proposed road was made by Forest Botanist Robert Thompson on November 4, 1993, for threatened, endangered and sensitive plant species (page 9B-5). He stated that the area was clear of any species of concern.

R645-301-322. Fish and Wildlife Resource Information.

No additional fish and wildlife resource information specific to the Tank Seam road and portal pad was provided in this amendment. The resource information included in the permit is general enough to cover this area which is close to the other disturbed areas. The raptor survey included the proposed area of disturbance. The entire area is classified as critical deer and elk winter range.

A letter dated December 23, 1992 from DWR (page 10D-18) recommended the current proposed road route over other alternative routes because of less impact. The letter states that the known golden eagles nest within one-half mile of the road are not located in direct line of site. However, the lower cliff areas are potential Townsend Big-eared bat habitat. A survey of the area for this species must be complete prior to construction of the road and pad as required by R645-301-322.100.

R645-301-410. Land Use.

No amendment to the plan has been made for this section. The stated premining land use for the area is wildlife and grazing. R645-301-411.110 requires the amendment to state the current land use for the area which in this case would be only wildlife. Due to the steepness of the site, livestock grazing would be prohibitive.

The current productivity of the area to be disturbed has not been described as required by R645-301-411.100. The Division will accept a letter from the SCS which states the estimated current and potential productivity of the reference area to fulfill this requirement.

R645-301-330. Operation Plan.

The amendment contains statements that the road fill material will be roughened, seeded and have erosion control matting installed to prevent erosion (page 3H-9). This commitment is a necessary interim step during the operational phase to control erosion and comply with R645-301-331. However, to achieve full compliance with the regulation and the approved permit, the amendment must commit to seeding the cut slopes.

R645-301-340. Revegetation.

Reclamation will be scheduled to allow revegetation of the Tank Seam road and pad in conjunction with backfilling and grading (page 3-108). Methods used for seedbed preparation are to use the bucket of the backhoe for ripping and scarifying to create horizontal pockets to aid in water retention (page 3-109). No further detail is given as to scarification. R645-301-341.220 requires the plan to contain sufficient detail so that the Division can make a finding of reclaimability. The plan must describe or illustrate the density and dimensions of the "horizontal pockets" that will be created during reclamation.

Seeding methods are unchanged with this submittal (page 9-14). The amendment states that the area will be mulched and then have erosion control matting applied. The amendment fails to state what mulch will be applied. R645-301-341.230 requires the plan to state the rate and type of mulch to be used.

The performance standards require mulch and other soil stabilizing practices to be used on all areas which are topsoiled. The amendment does not fulfill the requirements of R645-301-355, because the methods of soil stabilization are not described. The amendment does commit to the use of erosion control matting, however this is a temporary measure and does not provide for long-term control. The vegetative cover of the reference area is approximately 31 percent. The plan cannot rely on vegetation alone to control erosion on 2:1 and steeper slopes. Previous discussions have included the use of well placed and numerous boulders to provide the additional ground cover needed to control erosion. However, the amendment does not commit to the use or detail the installation and density of the boulders. This detail must be included in the amendment.

The success of the revegetation cover, shrub density and diversity of the reclaimed Tank Seam road will be compared to a grass reference area which is adjacent to and above the proposed portal pad area. This reference area is described in Appendix 9A and located on Plate 9-1.

R645-301-342. Wildlife Enhancement

The Tank Seam road and portal pad amendment will use the same wildlife

enhancement methods as described in the approved plan.

Stipulations

1. Adjacent to the proposed area of disturbance is potential Townsend Big-eared bat habitat. As required by R645-301-322.100, information must be included in the plan which demonstrates that the proposed disturbance will not impact the bats.

2. The plan states that the land use is grazing and wildlife which is incorrect for the road and pad area. The Operator must state the current land use for the proposed Tank Seam road and pad as required by R645-301-411.110.

3. The Operator must describe the current productivity of the area to be disturbed as required by R645-301-411.100.

4. The Operator must commit to interim stabilization of the cut slopes through prompt establishment of vegetation as required by R645-301-331.

5. The plan fails to state the rate and type of mulch to be used in final reclamation as required by R645-301-341.230. The Operator must provide the rate and type of mulch to be used.

ENGINEERING ANALYSIS

CERTIFICATION

Regulatory Reference: R645-301-512

Analysis: The maps which have been revised for the Tank Seam proposal are 2-4C--Surface Facilities, 2-4E--Surface Facilities, 3-1--Cross Sections, 3-2C--Post-Mining Topography, 3-2E--Post-Mining Topography, 3-4C--Bear Canyon No. 2 Mine, 3-5C--Road Details, 6-9--Interburden Isopach Map Bear Canyon Tank Seam, 6-10--Overburden Map Tank Seam, 6-11--Isopach Map Tank Seam, 6-12--Structure Contour Map Tank Seam, 7-1C--Hydrology Map, 7-1E--Hydrology Map, 7-4--Water Monitoring, 7-5--Watershed Map, 7-7--Post-Mining Watershed, 7-8C--Post-Mining Drainage Profiles, 8-1--Soils Map, 8-5C--Reclamation Area, 8-5D--Reclamation Area, 8-5E--Reclamation Area, 8-6--Proposed Tank Seam Road Topsoil Stockpile, and 9-1--Vegetation Map.

Of the maps listed above, only 2-4C, 2-4E, 3-1, 3-2C, 3-2E, 3-4C, 3-5C, 6-9, 6-10, 6-11, 6-12, 7-1C, 7-1E, 7-4, 7-5, 7-7, and 7-8C require certification by a professional engineer or land surveyor. All, however, have been certified by a qualified, registered,

professional engineer.

Location in Plan: Plates 2-4C, 2-4E, 3-1, 3-2C, 3-2E, 3-4C, 3-5C, 6-9, 6-10, 6-11, 6-12, 7-1C, 7-1E, 7-4, 7-5, 7-7, 7-8C, 8-1, 8-5C, 8-5D, 8-5E, 8-6 and 9-1.

Findings: The proposal fulfills the requirements of this section.

COMPLIANCE WITH MSHA REGULATIONS AND MSHA APPROVALS

Regulatory Reference: R645-301-513

Analysis: There are no coal processing waste dams or embankments, impoundments, refuse piles, underground discharges, or surface coal mining activities associated exclusively with the Tank Seam.

Three (3) new portals will be constructed for the Tank Seam: a fan portal, a belt portal, and an access portal. These portals will be constructed, maintained, and reclaimed in accordance with the approved plan.

Coal will be transferred from the Tank Seam to the Blind Canyon Seam by way of a 200-foot-deep, 8-foot-diameter vertical shaft. The opening of this shaft will be completely enclosed. The shaft will be raise bored along a pilot hole from the Blind Canyon Seam to the Tank Seam pad. The cuttings from the raise boring operation will be stored in the Blind Canyon Seam for final reclamation of the shaft. The shaft will then be lined with a 4-foot diameter steel tube. During final reclamation, the steel liner will be removed and the shaft will be completely backfilled from bottom to collar with the stored cutting material.

Location in Plan: Pages 3-2, 3-4, 3-87 and 3-101A.

Findings: The proposal fulfills the requirements of this section.

INSPECTIONS

Regulatory Reference: R645-301-514

Analysis: There are no structures or facilities associated exclusively with the Tank Seam which require inspections under this section.

Findings: The inspection procedures in the approved plan continue to apply, unchanged by the addition of the Tank Seam.

REPORTING AND EMERGENCY PROCEDURES

Regulatory Reference: R645-301-515

Analysis: The reporting and emergency procedures in the approved plan apply, without change, to the Tank Seam.

Findings: The reporting and emergency procedures in the approved plan continue to apply, unchanged by the addition of the Tank Seam.

PREVENTION OF SLIDES IN SURFACE COAL MINING AND RECLAMATION ACTIVITIES

Regulatory Reference: R645-301-516

Analysis: There are no surface coal mining and reclamation activities at this site.

Findings: This section is not applicable to the proposal.

OPERATION PLAN

Regulatory Reference: R645-301-520

GENERAL

Regulatory Reference: R645-301-521

Analysis: The maps which have been revised for the Tank Seam proposal are 2-4C--Surface Facilities, 2-4E--Surface Facilities, 3-1--Cross Sections, 3-2C--Post-Mining Topography, 3-2E--Post-Mining Topography, 3-4C--Bear Canyon No. 2 Mine, 3-5C--Road Details, 6-9--Interburden Isopach Map Bear Canyon Tank Seam, 6-10--Overburden Map Tank Seam, 6-11--Isopach Map Tank Seam, 6-12--Structure Contour Map Tank Seam, 7-1C--Hydrology Map, 7-1E--Hydrology Map, 7-4--Water Monitoring, 7-5--Watershed Map, 7-7--Post-Mining Watershed, 7-8C--Post-Mining Drainage Profiles, 8-1--Soils Map, 8-5C--Reclamation Area, 8-5D--Reclamation Area, 8-5E--Reclamation Area, 8-6--Proposed Tank Seam Road Topsoil Stockpile, and 9-1--Vegetation Map.

521.110 Previously Mined Areas--The Tank Seam lies entirely within the approved permit area. Therefore, the approved maps which show the location and extent of active, inactive, or abandoned underground mines or mine openings have not been and do not need

to be revised.

521.120 Existing Surface and Subsurface Facilities and Features--The Tank Seam lies entirely within the approved permit area. Therefore, the approved maps which show buildings, man-made features, public roads, etc., have not been and do not need to be revised.

521.130 Landowners and Right of Entry and Public Interest Maps--The Tank Seam lies entirely within the approved permit area. Therefore, the approved maps which show landowners and land boundaries have not been and do not need to be revised.

521.140 Mine Maps and Permit Area Maps--The Tank Seam lies entirely within the approved permit area. Therefore, the approved maps which show disturbed and affected areas, mine workings, etc., have not been and do not need to be revised.

521.150 Land Surface Configuration Maps--Plates 2-4C--Surface Facilities, 3-2C--Post-Mining Topography, 7-1C--Hydrology Map and 8-5C--Reclamation Area have been revised and Plates 2-4E--Surface Facilities, 3-2E--Post-Mining Topography, 6-10--Overburden Map Tank Seam, 7-1E--Hydrology Map, 7-8C--Post-Mining Drainage Profiles and 8-5E--Reclamation Area have been added to show the surface configuration of the area which appertains exclusively to the Tank Seam.

521.160 Maps and Cross Sections of the Proposed Features for the Proposed Permit Area--Plates 2-4C--Surface Facilities, 3-2C--Post-Mining Topography and 8-5C--Reclamation Area have been revised and Plates 2-4E--Surface Facilities, 7-1E--Hydrology Map and 8-6--Proposed Tank Seam Road Topsoil Stockpile have been added to show the buildings, roads, bonded areas, topsoil stockpiles, etc., which appertain exclusively to the Tank Seam.

521.170 Transportation Facilities Map--In order to accomodate the Tank Seam operation, one primary road--the Tank Seam access road--and one short conveyor will be added to the existing transportation facilities. Plates 2-4C--Surface Facilities, 3-1--Cross Sections, 3-5C--Road Details, 7-1C--Hydrology Map and 8-5C--Reclamation Area have been revised and Plates 2-4E--Surface Facilities, 7-1E--Hydrology Map, 8-5E--Reclamation Area and 8-6--Proposed Tank Seam Road Topsoil Stockpile have been added to show these new transportation facilities.

521.180 Support Facilities--The Tank Seam lies entirely within the approved permit area. Therefore, the approved maps which show support facilities have not been and do not need to be revised.

521.200 Signs and Markers Specifications--Specifications for signs and markers for the Tank Seam remain unchanged from those in the approved plan.

521.240 Mine and Permit Identification Signs--The Tank Seam lies entirely within the approved permit area. The sole access to the area is by way of the approved access road and gate. Therefore, the mine and permit identification signs remain unchanged.

521.250 Perimeter Markers--Perimeter markers will delineate the Tank Seam area in accordance with the approved plan. Perimeter marker specifications remain unchanged.

521.260 Buffer Zone Markers--There are no buffer zones in the Tank Seam area.

521.270 Topsoil Markers--Topsoil from the Tank Seam area will be stored in two (2) stockpiles: one on the present Upper Storage Pad and one at the first switchback of the Tank Seam Access Road. Both stockpiles will be marked by lengths of painted rebar as specified in the approved plan.

Location in Plan: Plates 2-4C, 2-4E, 3-1, 3-2C, 3-2E, 3-4C, 3-5C, 6-9, 6-10, 6-11, 6-12, 7-1C, 7-1E, 7-4, 7-5, 7-7, 7-8C, 8-1, 8-5C, 8-5D, 8-5E, 8-6 and 9-1.

Findings: The proposal fulfills the requirements of this section.

COAL RECOVERY

Regulatory Reference: R645-301-522

Analysis: The Tank Seam will add approximately 6 million tons to the present estimated in-place coal reserves. Mining will continue to be by room-and-pillar methods with pillar extraction, which methods yield, industry wide, an average recovery rate of 50 percent. The permittee expects to be able to recover approximately 60 percent of the in-place reserves, which has been the approximate recovery rate in the past at this site.

Location in Plan: Pages 3-20, 3-27 and 3-28.

Findings: The proposal fulfills the requirements of this section.

MINING METHOD(S)

Regulatory Reference: R645-301-523

Analysis: Mining will continue to be by room-and-pillar methods with pillar extraction, and pillar extraction will be done in the Tank Seam before being done in the lower seams. Coal will be taken from the Tank Seam operation by belt, transferred to the Blind Canyon Seam through a vertical drop shaft, and transported thence to the loadout facility by way of

the existing belt system.

The Tank Seam operation will produce from 200,000 to 300,000 tons per year. The operation will include three continuous miner sections and employ two shifts per day.

Location in Plan: Pages 3-4, 3-11, 3-20, 3-28 and 3-36. Plate 3-4C.

Findings: The proposal fulfills the requirements of this section.

BLASTING AND EXPLOSIVES

Regulatory Reference: R645-301-524

Analysis: Construction of the Tank Seam access road will require the use of explosives. Therefore, a blasting plan has been included as Appendix 3M.

524.100 Blaster Certification--Blasting will done under the direction of a certified blaster, a copy of whose certification is kept on file at the site. The certified blaster and at least one other person will be present at the firing of all blasts.

524.200 Blast Design--Holes will be 1¼ inches in diameter, 4 feet deep, and will be spaced on 4-foot centers. Irecoal D 378 explosive will be used with Ireco 25-millisecond delay detonators. Each hole will contain approximately 0.6 pounds, and each blast a total of 5 pounds or less, of explosive.

524.300 Preblasting Survey--Since no blast will total more than 5 pounds of explosive, the preblasting survey described in this subsection is not required.

524.400 Blasting Schedule--Since no blast will total more than 5 pounds of explosive, the blasting schedule described in this subsection is not required.

524.500 Blasting Signs, Warnings, and Access Control--During blasting, warning signs will be placed at all points of access to the permit area and the actual blasting area will be conspicuously flagged. In addition, audible warning and all-clear signals will be sounded before and after blasting. All employees and residents of the area will be informed of these signals and their meaning and their patterns and meaning will be described on each warning sign.

524.600 Control of Adverse Blasting Effects--As no buildings exist outside of and within one-half mile of the permit area, airblast and ground vibration will not exceed the limits set forth in this subsection at any building outside the permit area.

524.700 Records of Blasting Operations--A record of each blast will be kept at the site and made available, on request, to the Division and the public. The record will include the following:

1) The name of the operator conducting the blast.

2) The location, date, and time of the blast.

3) The name, signature, and certification number of the blaster supervising the blast.

4) The identification, direction, and distance of the nearest building outside the permit area.

5) Weather conditions.

6) A record of the blast specifications.

Location in Plan: Pages 3-30 and 3-34. Appendix 3-M.

Findings: The proposal fulfills the requirements of this section.

SUBSIDENCE

Regulatory Reference: R645-301-525

Analysis: Since the Tank Seam lies entirely within the approved permit area and directly above the existing Bear Canyon No. 1 Mine, the approved plan for monitoring, control and mitigation of subsidence has not been and does not need to be revised.

Findings: The approved plan for monitoring, control and mitigation of subsidence continues to apply, unchanged by the addition of the Tank Seam.

MINE FACILITIES

Regulatory Reference: R645-301-526

Analysis: Two new facilities have been added to the mine facilities description: the Tank Seam fan and the Tank Seam Borehole Structure.

The Tank Seam Fan will be located on the Tank Seam Portal Pad. This fan is MSHA approved and has the necessary safety guards in place.

The Tank Seam Borehole Structure is a vertical shaft which will transfer coal from the Tank Seam conveyor to the Bear Canyon No. 1 Mine, whence the coal will be transported to the coal stockpile by the existing conveyor system. Water for the Tank Seam operation will also be supplied through this shaft. The shaft will be 8 feet in diameter and will be lined with a 4-foot-diameter steel tube. Vibrators will be installed on the outside of the tube to dislodge coal which may jam in it and obstruct it. The shaft and the conveyor which feeds it will be completely enclosed by a protective structure.

Location in Plan: Pages 3-4, 3A-7 and 3A-17. Plates 2-4E and 7-1E.

Findings: The proposal fulfills the requirements of this section.

TRANSPORTATION FACILITIES

Regulatory Reference: R645-301-527

Analysis: Two new transportation facilities--a conveyor and a primary road--will be built for the Tank Seam operation.

The conveyor will take coal from the Tank Seam belt portal to a drop shaft, by way of which the coal will be transferred to the Bear Canyon No. 1 Mine for transportation to the existing coal loadout facility. The outside conveyor segment will be approximately 50 feet long and will be completely enclosed from the portal opening to the drop shaft.

The primary road, which will be called the Tank Seam Access Road, will connect the Upper Storage Pad with the Tank Seam Portal Pad. The road will be approximately 3000 feet long, 14 feet wide, and have grades which range from 9 percent to 16 percent. It will be constructed with cut-and-fill methods, with most of its length resting entirely on cuts made in the native surface.

Location in Plan: Pages 3-4, 3-6 and 3D-7. Appendices 3A, and 3H. Plates 2-4C, 2-4E, 3-1, 3-5C, 7-1C and 7-1E.

Findings: The proposal fulfills the requirements of this section.

HANDLING AND DISPOSAL OF COAL, OVERBURDEN, EXCESS SPOIL, AND COAL MINE WASTE

Regulatory Reference: R645-301-528

Analysis: Coal will be handled exclusively by conveyor. Coal will not be transported

over the Tank Seam Access Road.

A conveyor will take coal from the Tank Seam Belt Portal to a drop shaft, by way of which the coal will be transferred to the Bear Canyon No. 1 Mine. From the Bear Canyon No. 1 Mine, the coal will be transported to the existing coal loadout facility by the existing conveyor system. No coal washing or processing of any kind takes place at this site.

Noncoal mine waste will continue to be handled and disposed of according to the approved plan.

Location in Plan: Page 3-4. Appendix 3A. Plates 2-4E, 3-1, and 7-1E.

Findings: The proposal fulfills the requirements of this section.

MANAGEMENT OF MINE OPENINGS

Regulatory Reference: R645-301-529

Analysis: Three new portals and a shaft will be added to the existing mine openings to accomodate the Tank Seam: the Tank Seam Fan Portal, the Tank Seam Belt Portal, the Tank Seam Access Portal and the Tank Seam Borehole Structure. The 3 Tank Seam portals will be built, maintained, closed and maintained in accordance with the approved plan.

The Tank Seam Borehole Structure is a vertical shaft which will transfer coal from the Tank Seam conveyor to the Bear Canyon No. 1 Mine, whence the coal will be transported to the coal stockpile by the existing conveyor system. Water for the Tank Seam operation will also be supplied through this shaft. The shaft will be 8 feet in diameter and will be lined with a 4-foot-diameter steel tube. Vibrators will be installed on the outside of the tube to dislodge coal which may jam in it and obstruct it. The shaft opening will be completely enclosed by a protective structure.

Cuttings from the boring of the Tank Seam Borehole Structure will be stored underground in the Bear Canyon No. 1 Mine. During final reclamation, these cuttings will be used to completely backfill the shaft from bottom to collar.

Location in Plan: Pages 3-2, 3-4, 3-108 and 3A-7.

Findings: The proposal fulfills the requirements of this section.

OPERATIONAL DESIGN CRITERIA AND PLANS

Regulatory Reference: R645-301-530

GENERAL

Regulatory Reference: R645-301-531

SEDIMENT CONTROL

Regulatory Reference: R645-301-532

SEE R645-301-700 HYDROLOGY

IMPOUNDMENTS

Regulatory Reference: R645-301-533

Analysis: There are no impoundments which appertain exclusively to the Tank Seam. Therefore, the existing, approved impoundments have not been and do not need to be changed.

Findings: The existing, approved impoundments remain unchanged by the addition of the Tank Seam.

ROADS

Regulatory Reference: R645-301-534

Analysis: One new primary road will be built for the Tank Seam operation. This road, which will be called the Tank Seam Access Road, will connect the Upper Storage Pad with the Tank Seam Portal Pad.

The road will be approximately 3000 feet long, 14 feet wide, and have grades which range from 9 percent to 16 percent. It will be built with a ditch on the inside and a berm on the outside, and 10 CMP culverts will convey runoff beneath it from the ditch and from natural drainages which it will cross. It will be constructed with cut-and-fill methods, with most of its length resting entirely on cuts made in the native surface.

The road will be graded as necessary, in accordance with the approved road mainenance plan. In the winter, snow will be removed from the road surface and stored in the ditch at the inside of the road.

The operational road design was analyzed for stability by the consulting firm of Dames & Moore. The results of this analysis are contained in a May 6, 1994 report which has been included in the plan as part of Appendix 3H.

Dames & Moore first determined the material properties of the native material using a sieve analysis and a direct shear/normal stress test. The sieve analysis indicated that the material is, by the Unified Soil Classification System, a fine-grained soil. The direct shear/normal stress test indicated that the material has a cohesion of approximately 180 psf and displays a friction angle of approximately 32°.

Using these material property values, Dames & Moore then performed separate stability analyses of both the cut slope and the fill slope. Both were analyzed using a standard, two-dimensional, circular failure computer program. The cut slope was modelled at 1H:2V (63°), under dry conditions, with a conservative estimate of 6 feet of surface material over bedrock. The fill slope was modelled at 1H:1V (45°), also under dry conditions, and also with an estimated 6 feet of material over bedrock. In addition, the fill slope was modelled using the worst-case assumption of the road being built entirely on fill, which does not occur anywhere in the design. Dry conditions were assumed because of the relatively high proportion of silt- and clay-size material (37%) and the resultant low permeability of the native material.

Dames & Moore found that both the cut slope and the fill slope display a minimum safety factor of 1.4, which is higher than the value of 1.3 required by this section.

Using the data provided by Dames & Moore, the Division performed its own computer analysis of the stability of the operational road slopes. This analysis indicated the presence of a potential circular failure surface, with a safety factor of less than the required 1.3, which extends from the top of the fill into the native material and again emerges near the toe of the fill. Dames & Moore explained, both in telephone conversations with this writer and in a July 12, 1994 letter to the Division, that this failure surface, though indicated as a possibility by the Division's analysis, is very improbable for two reasons. First, even though the model, for simplicity, assumes a depth to a planar bedrock surface of 6 feet, in reality the surface material ranges from 0 to 3 feet in thickness and the bedrock surface is stepped and rough and often even exposed at the surface. This means that any failure through the native material would cut through bedrock--a very unlikely occurrence. Second, Dames & Moore's experience indicates that, in situations like that of the Tank Seam Access Road where fill is placed and compacted atop native material, any failures which occur almost always occur in the fill or along the boundary between the fill and the native material and rarely extend into the native material. This writer's experience also indicates that this is the case.

There was also concern on the part of some at the Division because Dames & Moore, after discussion with the permittee, amended the May 6, 1994 report, by changing some of its original construction recommendations. The May 6 report recommended that the fill be compacted in 8-inch lifts and that material larger than cobble be removed from the base of the fill. The amended report recommended that the fill be compacted in 18-inch lifts and that material larger than 18 inches be removed from the fill and placed at the fill surface. Dames & Moore explained, in a telephone conversation with this writer and in the July 12 letter to the Division, that the recommendation of 8-inch lifts was changed because it is a standard for foundation preparation and would thus be excessive in this case. Dames & Moore further explained that the important thing is that void spaces be properly eliminated from the fill to avoid excessive settling, but that the presence of large rocks can only enhance the stability of the fill since they increase its shear strength. Again, this writer's experience corresponds with that of Dames & Moore. This writer believes that the changes in the recommendations were proper and in line with good engineering judgement.

Location in Plan: Pages 3-4, 3-6 and 3D-7. Appendices 3A, and 3H. Plates 2-4C, 2-4E, 3-1, 3-5C, 7-1C and 7-1E.

Findings: The proposal fulfills the requirements of this section.

SPOIL

Regulatory Reference: R645-301-535

Analysis: There is no excess spoil to be disposed of at this site.

Findings: This section is not applicable to the proposal.

COAL MINE WASTE

Regulatory Reference: R645-301-536

Analysis: There is no surface disposal of coal mine waste at this site.

Findings: This section is not applicable to the proposal.

REGRADED SLOPES

Regulatory Reference: R645-301-537

Analysis: The permittee proposes no alternative specifications and claims no settled and revegetated fills at this site, but intends to use all available material in final reclamation.

Findings: This section is not applicable to the proposal.

RECLAMATION PLAN

Regulatory Reference: R645-301-540

GENERAL

Regulatory Reference: R645-301-541

NARRATIVES, MAPS, AND PLANS

Regulatory Reference: R645-301-542

Analysis:

542.100 Reclamation Timetable--Page 3-83 contains a reclamation timetable for the entire Bear Canyon site. Reclamation of the Tank Seam will add approximately 4 weeks to the overall reclamation schedule, which will take approximately 20 weeks.

542.200 Backfilling, Soil Stabilization, Compacting, and Grading Plan--Pages 3-2, 3-4, 3-108, 3-109, 3-110, 3-111 and 3A-7, Appendix 3H, and Plates 3-1, 3-2C, 3-2E, 7-7 and 7-8C comprise the plan for backfilling, soil stabilization, compacting and grading.

542.300 Final Surface Configuration Maps and Cross Sections--Pages 3H-13 through 3H-43 show cross sections of the original surface configuration to which the area will be reclaimed. Plates 3-1, 3-2C, 3-2E, 7-7 and 7-8C also depict the final configuration.

542.600 Road Reclamation--See R645-301-534 above.

542.700 Final Abandonment of Mine Openings--See R645-301-551 below.

542.720 Disposal of Excess Spoil--There is no excess spoil at this site. All available material will be used in final reclamation.

542.730 Disposal of Coal Mine Waste--No coal mine waste is to be disposed of at

this site.

542.740 Disposal of Noncoal Mine Wastes--Noncoal mine waste will be disposed of in accordance with the approved plan.

542.800 Reclamation Cost Estimate--Pages 3-83 through 3-105 show the reclamation cost estimate for the entire Bear Canyon site. These pages have been revised to include the reclamation costs associated with the Tank Seam. The reclamation of the Tank Seam raises the overall reclamation cost estimate from the present approved total of $340,415 to $427,097, in 1995 dollars.

Location in Plan: Page 3-2, 3-4, 3-83 through 3-105, 3-108, 3-109, 3-110, 3-111, 3A-7, 3H-13 through 3H-43, Plates 3-1, 3-2C, 3-2E, 7-7 and 7-8C.

Findings: The proposal fulfills the requirements of this section.

RECLAMATION DESIGN CRITERIA AND PLANS

Regulatory Reference: R645-301-550

CASING AND SEALING OF UNDERGROUND OPENINGS

Regulatory Reference: R645-301-551

Analysis: Three new portals and a shaft will be added to the existing mine openings to accomodate the Tank Seam: the Tank Seam Fan Portal, the Tank Seam Belt Portal, the Tank Seam Access Portal and the Tank Seam Borehole Structure. At final reclamation, the 3 Tank Seam portals will be closed and sealed in accordance with the approved plan.

The Tank Seam Borehole Structure is a vertical shaft which will transfer coal from the Tank Seam conveyor to the Bear Canyon No. 1 Mine, whence the coal will be transported to the coal stockpile by the existing conveyor system. Water for the Tank Seam operation will also be supplied through this shaft.

Cuttings from the boring of the Tank Seam Borehole Structure will be stored underground in the Bear Canyon No. 1 Mine. During final reclamation, these cuttings will be used to completely backfill the shaft from bottom to collar.

Location in Plan: Pages 3-2, 3-4, 3-108 and 3A-7.

Findings: The proposal fulfills the requirements of this section.

PERMANENT FEATURES

Regulatory Reference: R645-301-552

Analysis: The permittee plans to leave no permanent features at this site.

Findings: This section is not applicable to the proposal.

BACKFILLING AND GRADING

Regulatory Reference: R645-301-553

Analysis: Reclamation of the Tank Seam area will involve sealing and backfilling of the portals, backfilling of the shaft, and restoration of the access road and pad to the original surface configuration. No highwalls, spoil piles, depressions or refuse piles will be left.

The road and pad will be backfilled starting at the pad. A backhoe will reach over the edge to retrieve displaced material and place that material on the surface. The material will be compacted by the backhoe in 18-inch lifts. Topsoil will be placed on the surface of the fill as it is constructed and then scarified with the bucket of the backhoe.

The reclaimed road design was analyzed for stability by the consulting firm of Dames & Moore. The results of this analysis are contained in a May 10, 1994 report which has been included in the plan as part of Appendix 3F. This analysis made use of the material properties determined for the operational analysis, which is included in Appendix 3H.

Dames & Moore determined the material properties of the native material using a sieve analysis and a direct shear/normal stress test. The sieve analysis indicated that the material is, by the Unified Soil Classification System, a fine-grained soil. The direct shear/normal stress test indicated that the material has a cohesion of approximately 180 psf and displays a friction angle of approximately 32°.

Using these material property values, Dames & Moore performed separate stability analyses of both the cut slope and the fill slope. Both were analyzed using a standard, two-dimensional, circular failure computer program. Both were modelled at 1H:2V (63°), under dry conditions, with a conservative estimate of 6 feet of surface material over bedrock. Dry conditions were assumed because of the relatively high proportion of silt- and clay-size material (37%) and the resultant low permeability of the native material.

Dames & Moore found that the cut slope displays a minimum safety factor of 1.8 and that the fill slope displays a minimum safety factor of 1.4, both of which are higher than the

value of 1.3 required by this section.

Using the data provided by Dames & Moore, the Division performed its own computer analysis of the stability of the reclaimed road slopes. This analysis indicated that the reclaimed slope designs indeed display the required safety factor.

There was concern on the part of some at the Division because Dames & Moore, after discussion with the permittee, amended the May 10, 1994 report, by changing some of its original construction recommendations. The May 10 report recommended that the fill be compacted in 8-inch lifts and that material larger than cobble be removed from the base of the fill. The amended report recommended that the fill be compacted in 18-inch lifts and that material larger than 18 inches be removed from the fill and placed at the fill surface. Dames & Moore explained, in a telephone conversation with this writer and in the July 12 letter to the Division, that the recommendation of 8-inch lifts was changed because it is a standard for foundation preparation and would thus be excessive in this case. Dames & Moore further explained that the important thing is that void spaces be properly eliminated from the fill to avoid excessive settling, but that the presence of large rocks can only enhance the stability of the fill since they increase its shear strength. Again, this writer's experience corresponds with that of Dames & Moore. This writer believes that the changes in the recommendations were proper and in line with good engineering judgement.

Location in Plan: Pages 3-4, 3-6, 3-108, 3-109, 3-110, 3-111 and 3D-7. Appendices 3A, and 3H. Plates 3-1, 3-2C, 3-2E, 7-7 and 7-8C.

Findings: The proposal fulfills the requirements of this section.

STABILITY SYNOPSIS

Cut Slopes: The Division evaluated the cut slopes, in the Dames and Moore report, on the Tank Seam access road. The Dames and Moore report examined two cut slopes for reclaimabilty and one for stability. Dames and Moore reported that all the cut slopes would meet the minimum static safety factor of 1.3.

The Division evaluated the cut slopes using SB-STABLE. In the Division's initial study the soil, rock properties, and slope profiles were the same as those used by Dames and Moore. The Division's analysis also showed that the cut slopes would have a minimum static safety factor exceeding 1.3 during construction and reclamation.

Fill Slope: The Dames and Moore report examined fill slope profile for stability. The fill slope profile is shown in Plate 3. The natural slope in Plate 3 has an angle of 35 degrees while the fill is 45 degrees. The natural slope is shown to consist of soil.

An assumption used in the Dames and Moore report was that the critical failure surface would be at the contact between the fill and the natural soil. No other failure surfaces, for the fill slope, were examined in the Dames and Moore report. Dames and Moore found the safety factor to be 1.44.

The Division determined the safety factor, along the contact between the fill and natural slope, to be 1.4. The Division then examined other failure surfaces that were not explored by Dames and Moore. Several failure surfaces were found that did not meet the minimum safety factor. Some of them had a safety factor lower than 1.1. Those slip surfaces would begin at the outer edge of the road, go through the fill into the natural soil, and exit below the fill's toe.

The text describes the slopes as consisting of bedrock covered with soil. The plate used to describe the cut slope showed the bed rock covered with 6 feet of soil. The Division modified the slope stability model, so the natural slope consisted of bedrock covered with 6 feet of soil. The rock properties used in the cut slope analysis were used in the model.

SB-STABLE found some failure surfaces that went from the fill into the natural soil, into the bedrock, and the back into the natural soil and fill. That type of failure seemed unlikely to the Division. To prevent such failure from occurring in the model the Division increased the rock's strength parameters in the model. Failure surfaces with safety factor of 1.1 were found using the modified profile.

The Division informed Co-Op Mining of the results and they passed the analysis on to Dames and Moore. In a draft letter to Co-Op, Dames and Moore stated the slope's profile in the initial study had been overly simplified. Instead of a smooth slope with a uniform soil cover the natural slope consisted of bedrock "steps". The bedrock is exposed in some areas of the slope and covered with 2 to 3 feet of soil in others. Dames and Moore felt that if bedrock steps were added to the model, then the natural slope would not fail.

The Division then modified its model by assigning rock properties to all areas of the natural slope. Safety factors of 1.31 were discovered for some failure surfaces.

Until then all models had been run using dry soil parameters. It was assumed that since the bedrock was close to the surface any pore pressure would be minor. When saturated conditions were used (still no pore pressure) the lowest static safety factor was 1.29.

The Division then ran the model, assuming dry conditions and 2 feet of soil covering the bedrock. The lowest safety factor was 1.2. The contact between the fill and natural slope is 90 feet. The critical failure surface extended 40 feet into the natural soil. **Dames and Moore did not state what the maximum spacing of the steps was. If a 40-foot width**

between steps does occur near the toe then the slope will have not met the minimum safety requirements. When saturated conditions were assumed with 2 feet of soil cover, the safety factor dropped to 1.15.

The Division contacted UDOT for their opinion on placing fill, that will have a 45 degree slope, on a 35-degree slope. They said that they would not recommend placing any fill on a 35-degree slope.

STABILITY

Cut Slopes and Reclamation: Using the information supplied by Dames and Moore the Division performed a slope stability analysis. The Division's results agreed with the Dames and Moore study that showed the cut-slopes to be stable and reclaimable.

Fill Slope: The Division did not agree with the initial Dames and Moore study regarding the fill-slope. Even after the Division added a strong bedrock layer 6 feet under the natural soil the safety factor continued to be 1.1.

When Dames and Moore learned of the low safety factor they revised their assumptions about the slope's profile. They claimed that if the slope was modeled with bedrock steps then the safety factors would be satisfactory. Dames and Moore did not supply the Division with any information on the steps spacing or demonstrate that the steps would prevent failure.

When the Division analyzed the slope using Dames and Moore revised assumptions the safety factor was 1.31. When saturated soil conditions were assumed the safety factor dropped to 1.29. The regulations require road embankments to have safety factors no less than 1.3.

The bedrock step spacing is important. The Division has demonstrated that if a 40 gap in the bedrock can result in a safety factor of 1.2.???????? While Dames and Moore's assumption about steps may appear reasonable they have supplied the Division with no information that such conditions will occur on all fill surfaces.

In the model the fill did not fail because it has high strength parameters. The strength parameters were based on one soil sample. If the parameters are decreased slightly then the fill failures have the required safety factor.

The model is very sensitive to small changes in slope profile and material properties. If the Operator is allowed to construct fill slope then he must supply the Division with detailed as-built designs demonstrating the slope's stability.

SB-SLOPE

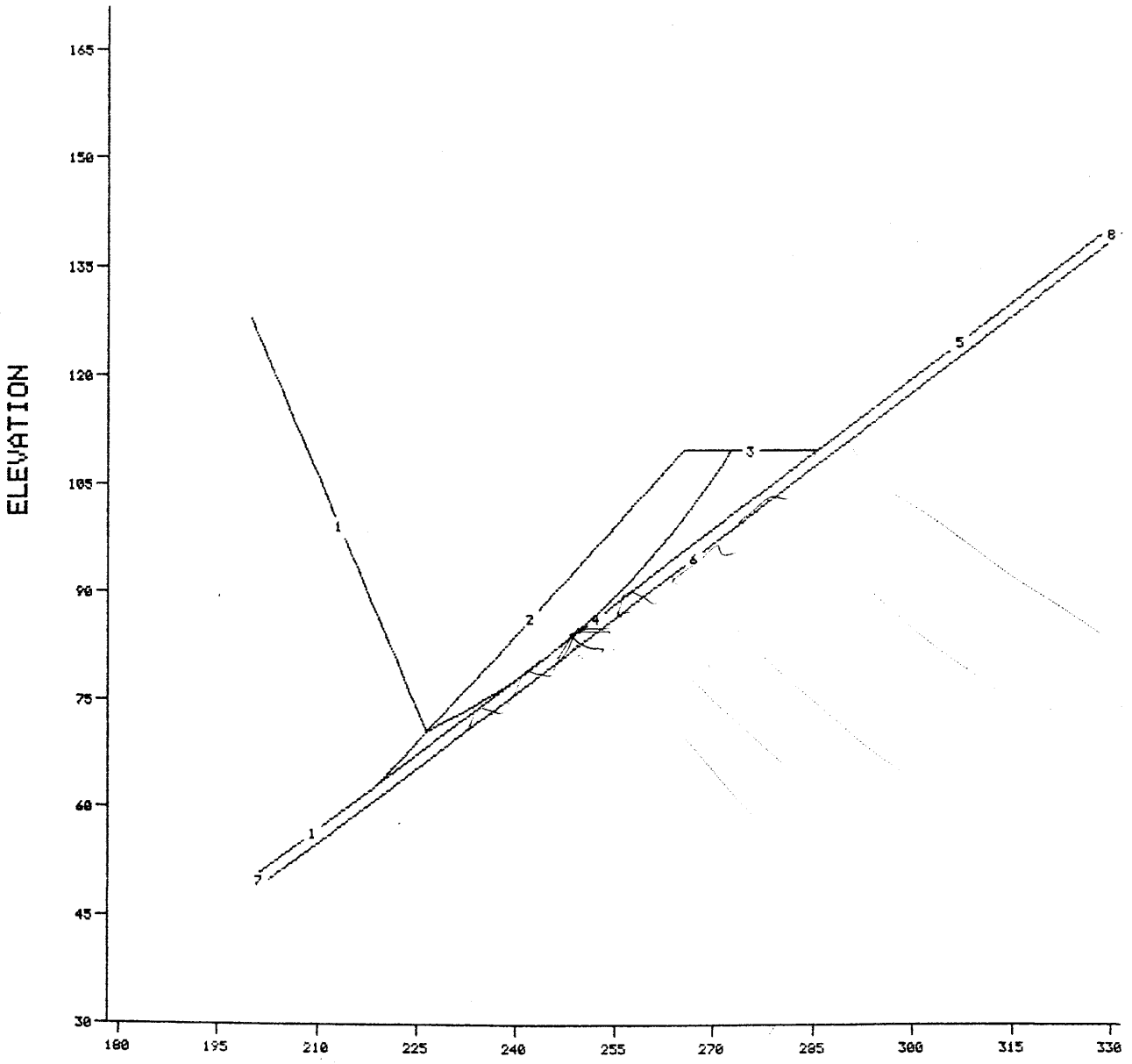
Simplified Bishop Slope Stability Analysis

PROJECT: TANK SEAM ROAD

LOCATION: COOP

FILE: TANK5 COMPLETE SLOPE CROSS SECTION

CIRCLE	X	Y	RADIUS	FS
1	179.0	173.5	113.2	1.31



Stipulations

6. The Operator must expose bedrock when needed to ensure that the slope is stepped.

7. The Operator must test fill material prior to placement.

8. The Operator must submit detailed slope profiles and stability analysis for each fill-slope.

BASELINE DATA

R645-301-729. Cumulative Hydrologic Impact Assessment

Revised Hydrologic Evaluation of the Bear Canyon Mine

In the review of additional information to put together the 'Revised Hydrologic Evaluation of the Bear Canyon Mine' the following items were considered: 1) the updated PHC (Probable Hydrologic Consequences) data submitted by Co-Op Mining Company, and 2) the September 9, 1993 informal hearing transcripts.

Ground Water

Within the vicinity of the Bear Canyon Mine, two major springs have been identified: Big Bear Springs and Birch Springs. Big Bear Springs (maintained by the Castle Valley Special Services District) discharges from three prominent joints. Birch Springs (maintained by the North Emery Water Users) discharges from the normal fault which has approximately 20 feet of vertical displacement. Both springs discharge from the lowest sandstone unit of the Star Point Sandstone (Panther Tongue), where the Mancos Shale acts as a barrier to the downward movement of groundwater. As a result of the Order issued by the Division of Oil, Gas and Mining, Co-Op Mining Company initiated a drilling program to better define the ground water flow path associated with the Blackhawk-Starpoint aquifer in the area of the mine.

Although a regional aquifer (termed the Star Point - Blackhawk Aquifer by Danielson, et al., 1981) has been designated for the area, in-mine drilling and aquifer testing conducted for this study area indicate that three aquifers within the Star- Point Sandstone have individual static water levels. Further, in the southernmost hole (DH-3) shown on Plate 2, PAP, none of the three aquifers are fully saturated. This fact indicates that each of the units have a separate and distinct water levels. The springs issue from the bottom of the Panther Tongue (417 - 433 feet below the Blackhawk formation contact with the Star Point Sandstone), therefore, Birch Springs and Big Bear Springs are hydrologically isolated from the impacts of

mining in the Blackhawk Formation by the presence of two Mancos Tongues in the Star Point Sandstone.

Areas of encountered groundwater within the mine are fractures which drain over a period of several months as the mine advances northward. This indicates a high degree of hydraulic interconnection through fractures in the portion of the Blackhawk Formation which overlies the mine. Inflows in the north end of the North Main and Second East entries are through roof bolt holes and hairline fractures which are presumed to drain overlying perched aquifers in the Blackhawk Formation. The current rate of discharge from the mine is approximately 300 GPM.

Big Bear Springs and Birch Springs in the vicinity of the Bear Canyon Mine issue from joints at the contact between the Panther Tongue and the Mancos Shale. The majority of water inflows in the mine are through bolt holes and fractures draining perched aquifers in the Blackhawk and an indeterminate amount of interception of water from the floor in the area of the Second East entries. The review of water source information, the graphical tracking of precipitation versus flow, the testing of the spring water and mine water quality for tritium dating, analysis of water quality chemical data using Stiff and Piper diagrams, and the known presence of three separate piezometric surfaces based on drilling in the Spring Canyon, Storrs, and Panther Tongues of the Star Point Sandstone leads to a conclusion of no significant material damage to the Hydrologic Balance outside the permit area.

Future Mining in the Tank Seam above the Bear Canyon Seam

The Co-Op Mining Company has drilled 8 exploratory drill holes into the Tank Seam (page 2-13, Appendix 7 - J, PAP). All were dry except one which flows at .5 GPM (drilled up from the mine workings in the Blind Canyon Seam). The inflows into the Tank Seam are expected to be much less than those encountered in the Blind Canyon Seam. Stratigraphically, the Tank Seam is 250 feet above the Blind Canyon Seam and therefore, would tend to be drier and not expected to have the ground water inflows found in lower coal seams (i.e., the Blind Canyon and the Hiawatha Seams). There has been no continuous water quality problems associated with mine water discharge at the Bear Canyon Mine and therefore it is not expected to change in the future, although it will be closely watched for any long term trends.

Surface Water

The Permittee has submitted information in their PHC which documents the quality and quantity of surface water routinely collected in the permit and adjacent areas from stations located on Bear Creek and Trail Creek. Analytical data from these sources are summarized in Chapter 7 of the PAP and the Annual reports. Locations of these monitoring points are

presented on Plate 7-4 of the PAP. The following potential impacts are discussed in the PHC on pages 3-10 thru 4-3:

- Contamination from acid- or toxic-forming materials;
- Increased sediment yield from disturbed areas;
- Flooding or stream flow alteration;
- Impacts to the chemical quality of surface water; and
- Impacts to surface water quantity.

The Permittee has provided a summary of the potential impacts based on the Potential Magnitude of Impact and the Probability of Occurrence. The two potential impacts to surface water quality with moderate or high probability of occurrence are in order, road salting and mine discharge. Both potential impacts are being monitored, by monitoring treatments in place (i.e. sediment ponds). Any mitigation of road salting within the permit area will be based on UPDES permit requirements. The monitoring of discharge and underground occurrence are in place to determine if mitigation measures are needed.

The Permittee has provided an adequate erosion and sediment control plan for reclamation of the Tank Seam and therefore a Cumulative Hydrologic Impact Assessment can be completed.

Finding

The Permittee has met the requirements of the rules regarding the collection of Baseline ground and surface water data. The Permittee has also provided an accurate assessment of the potential impacts from mining the Tank Seam. The Permittee has met the requirements of the rules regarding erosion and sediment control for reclamation.

EROSION AND SEDIMENT CONTROL

R645-301-741 thru
742.126 and 742.240 Sediment Control Measures

Operation Plan

The Permittee is proposing to build a road and pad area isolated from the normal sediment control facilities at the main facilities area in steep canyon which is considered a space limited environment. Therefore, the Operator has decided to treat all disturbed areas using alternative sediment control (i.e., silt fence and erosion control matting). The Permittee meets the regulatory requirements of R645-301-741 through 742.126 and 742.240. The construction procedures for installation of sediment controls are described on pages 3H-

2, 3H-3, Figure 3H-2, and 3H-6, 3H-9, and 3H-10. Each BTCA area is described in appendix 7-K. Approximate silt fence locations are shown on Plates 7-1C and 7-1E. As-built drawings will be submitted following construction(page 3H-10). A berm will be constructed on the downhill side of the road cut. A drawing of the berm configuration is shown on figure 3H-1 and 3H-2. When the berm is in place, the road cuts will be started using a front end loader and/or backhoe. The road cuts will be made into the slope towards the cut face rather than parallel to the slope to allow any slough to be contained within the berm.

Culverts will be installed on the fill slope as construction progresses upslope. Culvert outlets will be protected as described in Section 7.2.7.3., Table 7.2-11, Culvert Characteristics describes the size of culverts and the outlet conditions.

Reclamation

The Permittee commits to erosion control matting on slopes greater than 2:1 in section 3.6.4 of the Bear Canyon plan and page 3-111 of the Tank seam submittal. The permit does have a comprehensive maintenance plan for erosion. The Permittee has included a plan found on pages 3-81 and 7K-15 of PAP for monitoring sediment contributions and maintaining erosion following reclamation of the site.

Findings

The Permittee has met the requirements of the sediment and erosion control rules. The plan minimizes erosion to the extent possible and prevents additional contributions of sediment to stream flow.

SURFACE WATER DIVERSIONS

R645-301-742-300. Diversions

Operation Plan

A summary of surface water diversions calculations can be found in Table 7.2-10. A table describing ditch characteristics for disturbed area ditches is found on pages 7G-46 and 47. Table 7.2-11, Culvert Characteristics, summarizes the outlet conditions for each constructed culvert. Page 7G-24A and B gives the culvert size, type, contributing watersheds, Peak Q(cfs), slope(ft/ft), and outlet condition.

The Permittee has used the SCS curve number methodology to generate peak flows. These flows are used to assess the adequacy of the culverts. The curve numbers were

chosen, peak flows generated based on watershed characteristics, and the Flowmaster computer program used to size or determine the adequacy of the culverts and road side ditches to pass the necessary flows from the 10 year-6 hour design storm.

Reclamation

The reclaimed Tank Seam access road channel designs are discussed on pages 7H-52 through 7H-77. The peak flows for all the six reclaimed channels are found on pages 7H-65 showing maximum velocity and maximum flow depth.

With review of this background information, it appears that stable reclamation is the single most important issue concerning diversions. Due to the steep maximum slopes (beyond the angle of repose), the drainages can not be reclaimed in a stable manner with riprap. Therefore, the drainages must be reclaimed back to stable natural drainage characteristics using the current drainages as a guide. None of the existing boulders or natural riprap will be removed, only the fill placed in the drainage. The Permittee has provided the documentation of the current drainages in the form of photos, average bottom widths, average depths, and average slopes. Characteristic rock sizes are also given for each channel. Profiles of the pre-mining, and subsequently the proposed post-mining channels are shown on Plate 7-8C. This information will allow for accurate reclamation of the disturbed portions of the channels by mimicking the premining conditions.

The Permittee will be required to prevent additional contributions of sediment to stream flow outside the permit area. It is recommended that the Permittee monitor overland flows from undisturbed and disturbed reclaimed areas to gain some understanding of what the expected sediment concentrations are in terms of settleable solids, suspended solids, and particle size distributions. The Division currently has a program where overland flow samplers can be gotten from the Division and used to collect these type of analysis. In the plan the Operator has mentioned the use of erosion control matting and other methods to control erosion.

Finding

The Permittee has met the requirements of the rules by providing an adequate plan, discussing the reclamation of the channels which provides for natural restoration of the channels back to premining conditions characteristic of the natural watersheds prior to mining.